(12) UK Patent Application (19) GB (11) 2 414 635 (13) A

(43) Date of A Publication 30.11.2005

(21) Application No: 0506995.0

(22) Date of Filing: 06.04.2005

(30) Priority Data:
(31) 0407929 (32) 07.04.2004 (33) GB

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(51) INT CL⁷:
H04Q 7/22 , H04L 12/18

(52) UK CL (Edition X):
H4L LDPAF L209 L213

(56) Documents Cited:
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GB 2398971 A   WO 2005/078962 A1
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(58) Field of Search:
UK CL (Edition X) H4L
INT CL⁷ H04B, H04L, H04Q
Other: Online: WPI, EPODOC, JAPIO

(54) Abstract Title: **Providing scheduling information for multicast and/or broadcast services, e.g. MBMS**

(57) A method of providing a multicast and/or broadcast service in a mobile telecommunications network, wherein transmission times for the services are scheduled and scheduling information is transmitted from a network node to a mobile terminal and wherein the scheduling information is provided according to a predefined schedule. The service may be a Multimedia Broadcast/Multicast Service (MBMS). In other methods, multicast and/or broadcast services are scheduled and the scheduling information content is arranged to cover particular transmission periods and/or services. Other methods disclose data relating to a multicast and/or broadcast service being grouped together before transmission, e.g. by delaying some data.
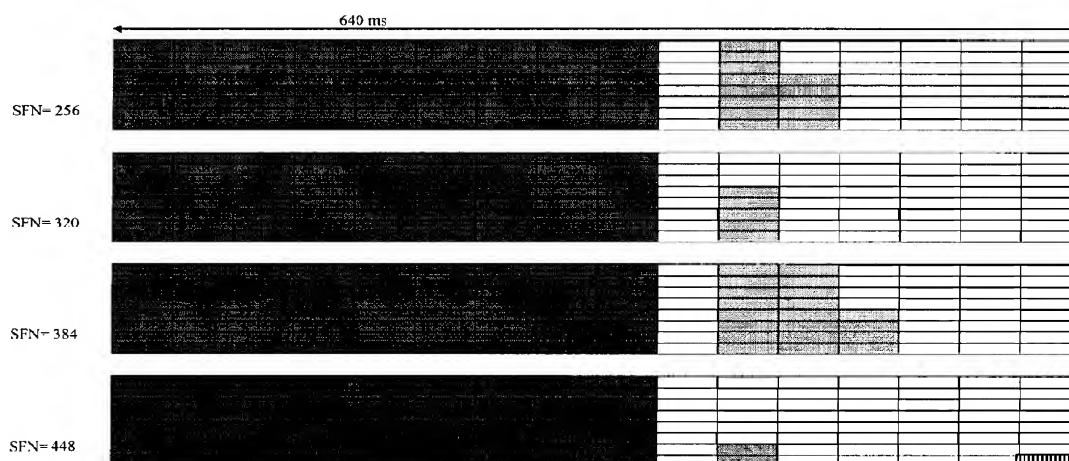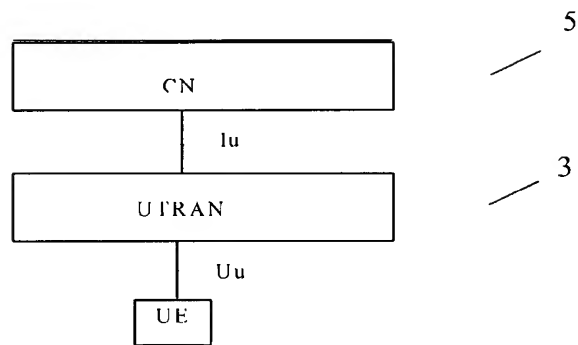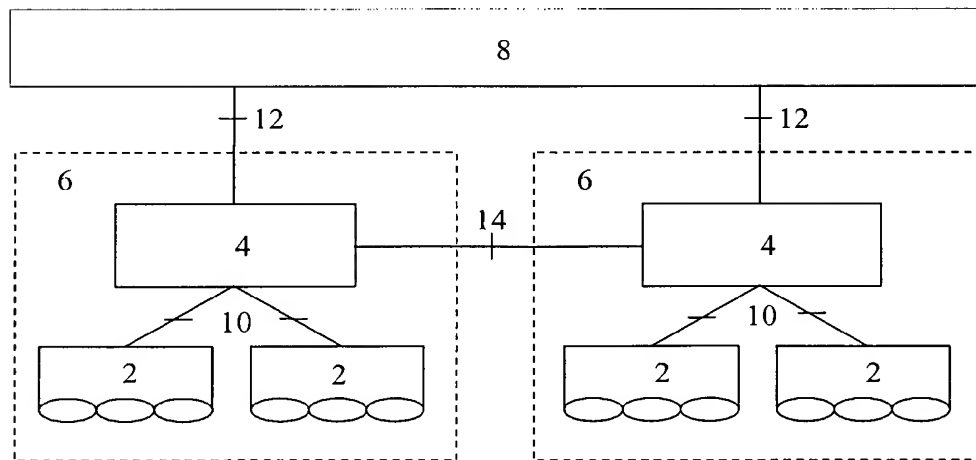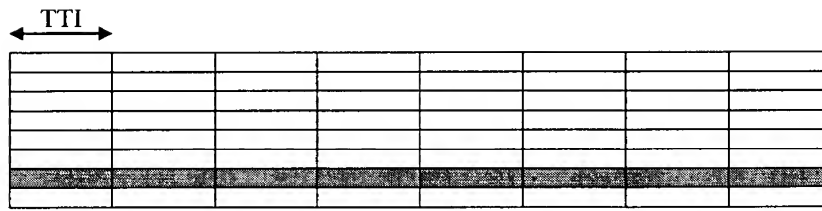
Fig. 4

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Fig. 1

Fig. 2

Fig. 3A

Fig. 3B

Fig.3

640 ms

SFN= 256

SFN= 320

SFN= 384

SFN= 448

Fig. 4

640 ms

SFN= 256

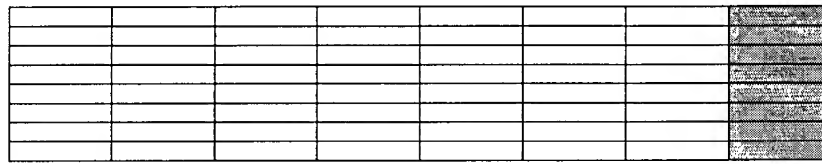SFN= 320
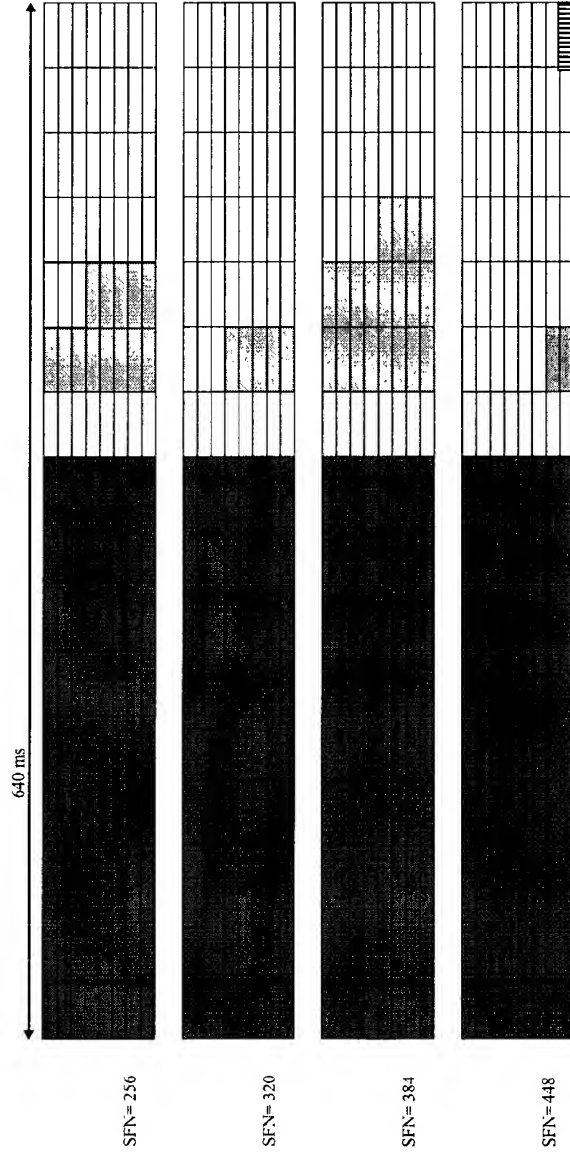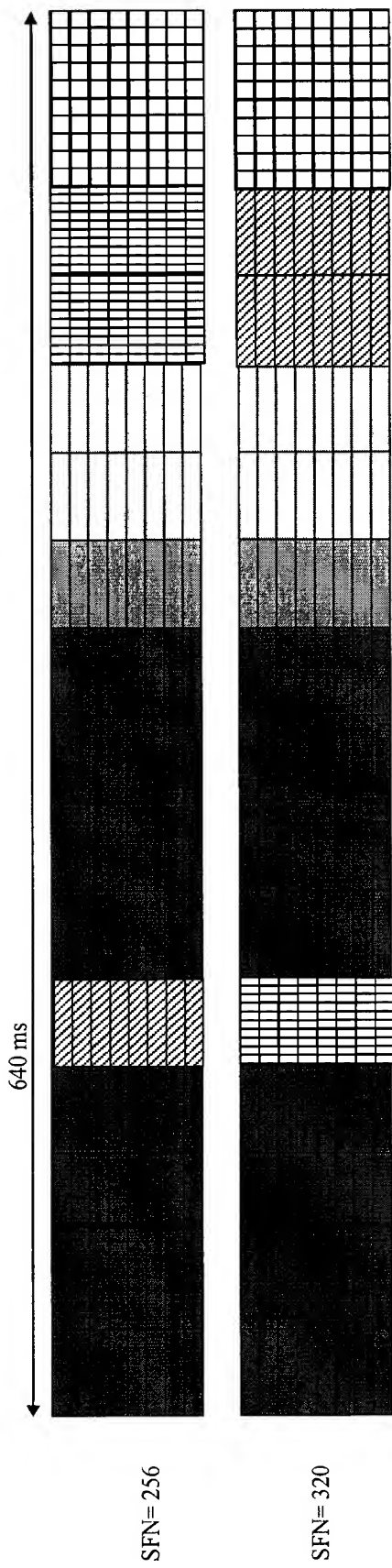
Fig. 5

Mobile Communications

This invention relates to a broadcast or multicast service in a telecommunications system. More explicitly, but not exclusively, the invention relates to the realisation of a Multicast Broadcast services in a radio access network (RAN) such as in the Universal Mobile Telecommunications Service (UMTS) radio access network in regard of Scheduling information for a Multimedia Broadcast/Multicast Service (MBMS). UMTS concerns a third generation radio network using wideband code division multiple access (W-CDMA) technology.

A cellular communications system includes mobile user equipment (UEs), a radio access network (RAN) and one or more core networks (CNs), as illustrated in Figure 1 for the UMTS case. A detailed overview over the architecture of a cellular telecommunications system of the third generation may be found in the 3GPP specification "UTRAN Overall Description" 3GPP TS25.401 and related specifications. Communication between the UEs and the UTRAN is provided via the Uu interface (Uu), whereas the communication between the UTRAN and the core networks is done via the Iu interface (Iu).

A radio access network includes base stations and radio network controllers or base station controllers (RNC/ BSC). The base stations handle the actual communication across the radio interface, covering a specific geographical area also referred to as a cell. The radio network controllers control the base stations connected to it, but in addition perform other functionality like for example the allocation of radio resources and the control of local mobility. An RNC connects to one or more core networks via the Iu interface, to a number of base stations (node B's for the case of UTRAN) via the Iub interface and possibly to one or more other RNCs via the Iur interface. The core network includes a serving GPRS (General Packet Radio Service) support node (SGSN) and a broadcast/multicast - service centre (BM-SC).

The BM-SC controls the distribution of the data to be transmitted via the MBMS service.

Communications Networks of the third generation (3G) such as the UMTS network provide Multimedia Broadcast Multicast Services (MBMS). MBMS is a point-to-multipoint service in which multimedia data such as audio, images or video data is transmitted from a single source entity to multiple recipients by using an uni-directional bearer service. The MBMS bearer service offers both a broadcast mode and a multicast mode. In the broadcast mode, the data are broadcasted to all users. In contrast, a user needs to subscribe to a particular MBMS service or a group of MBMS services with a service provider in order to receive multicast services. The operator may then announce the service or use a service discovery mechanism to inform users about the range of MBMS services available. If the user is interested in a particular MBMS service, the user joins the service, i.e. the user activates the MBMS multicast service. In this way the user becomes a member of a particular multicast group and indicates to the network that he or she wants to receive the MBMS data of a particular MBMS service.

The area in which a specific MBMS Bearer Service is available is referred to as the MBMS Service Area, or the MBMS Multicast (MC)-service area It is defined individually per MBMS Bearer Service, i.e. the MBMS service area is MBMS service specific. Such a MBMS service area consists of a number of cells. An MBMS MC-service area might not have any relation to other area of the network, such as the UTRAN Registration Areas (URA's), Routing Areas (RAs) or Location Areas (LAs). Thus, an MBMS MC-service area may consist of some cells of a URA, RA or LA, without necessarily including all cells of that URA, RA or LA.

More information regarding MBMS realisation in the UTRAN may be found in the corresponding stage-2 document "Introduction of Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (RAN)", TS 25.346.v2.6.0.

Transmitting the same data to multiple recipients allows network resources to be shared. In this way the MBMS architecture is designed to enable an efficient usage of radio-network and core-network resources.

In order to initiate a MBMS session, the CN sends a session start command to the RNC. The Session Start command is used to indicate that the core network is ready to send data relating to a particular MBMS service. The Session Start command triggers the establishment of a bearer resource for MBMS data transfer. It is noted that the Session Start occurs independently of activation of the service by the user. This means that a user may activate a particular service either before or after a Session Start.

After receiving the Session Start command, the RNC send MBMS notifications to the UE in order to inform the UEs about forthcoming or even ongoing MBMS multicast data transfers. The RNC manages the use of the radio resources and decides whether the MBMS data will be transmitted using point to multipoint or point-to-point transfer mode on the radio interface. If there are sufficient UEs in a cell, the point-to-multipoint transfer mode is most efficient. If however the number of users in a cell is low, the point-to-point transfer mode may be most efficient. To decide which transfer mode to use, the RNC may perform a counting operation. Subsequently multimedia data relating to a particular MBMS service are transmitted from the CN via the RNC to the UEs during the data transfer phase.

When the BM-SC determines that there will be no more data to send, the CN sends a Session Stop command to the RNC and the bearer resources are released

If a user is no longer interested in a particular MBMS service, the user deactivates the service. Accordingly, the user leaves the multicast group if he or she does no longer wants to receive Multicast mode data of a specific MBMS bearer service.

It is noted that the phase subscription, joining and leaving are performed individually per user. The other phases, such as the notification and the data

transfer, are performed for a particular service, i.e. for all users interested in the related service.

As of 3GPP RAN2 meeting number 41 (16-20 February 2004), the situation regarding how MBMS will be handled on the Uu interface has again

5 become clearer. The current status of MBMS realisation in RAN2 is described in the 3GPP specification "Introduction of Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (RAN)" TS 25.346 (v2.6.0) .

During RAN2 meeting number 41, it was decided that there will be MBMS scheduling information provided on an secondary Common Control

10 Physical Channel (SCCPCH), and that this scheduling information would concern the MBMS services provided on this SCCPCH.

Currently, scheduling information is already provided on the GSM/UMTS radio interface for the Cell Broadcast Service (CBS). Like MBMS, CBS is also a broadcast type of service (point-to-multipoint

15 transmission). However CBS is restricted to much lower rates as MBMS and is focussed on text based services.

CBS is specified in the 3GPP specification "Short Message Service Cell Broadcast (SMSCB); support on the mobile radio interface for GSM" (TS 44.012), and 3GPP specification "Broadcast/Multicast Control (BMC) for

20 UMTS" (TS 25.324).

One possibility to implement the scheduling for the MBMS service would be to apply a scheduling procedure in analogy to that described for the CBS service.

For the CBS service (see the specifications TS 44.012 and TS 25.324

25 for more details), it is exactly described which messages (based on message ids) are going to be sent in timeslots in the coming period. In UMTS, the maximum time period is described to be 2.56 seconds. The messages to be transmitted are indicated by message identifications (message Ids).

A straightforward application of the CBS approach would be to signal

30 in the scheduling message which services are going to be provided within a

certain time period. This time period can for example be determined to be the next 50 System Frame numbers (SFNs).

It is an aim of the present invention to improve the scheduling method described above.

5   According to one embodiment of the present invention, there is provided a method of providing a multicast and/or broadcast service in a mobile communications network, including transmitting data for a multicast and/or broadcast service from a network node to a mobile terminal, wherein transmission times for transmitting data relating to the service are scheduled

10   and wherein scheduling information is transmitted from a network node to a mobile terminal, and wherein transmission of at least some of said data is delayed so that data relating to said service are grouped together before transmission.

According to another embodiment of the present invention, there is

15   provided a method of providing multicast and/or broadcast services in a mobile communications network, wherein transmission times for the service are scheduled and scheduling information including the start times of the transmission related to a particular multicast and/or broadcast service is transmitted from a network node to a mobile terminal.

20   According to another embodiment of the present invention, there is provided a method of providing multicast and/or broadcast services in a mobile communications network, wherein transmission times for the services are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and wherein the transmission periods covered by the

25   scheduling information are specific to a particular multicast and/or broadcast service.

According to another embodiment of the present invention, there is provided a method of providing a multicast and/or broadcast service in a mobile communications network, wherein transmission times for the service

30   are scheduled and scheduling information is transmitted from a network node

to a mobile terminal, and wherein the scheduling information is provided according to a predefined schedule.

According to another embodiment of the present invention, there is provided a method of providing multicast and/or broadcast services in a mobile communications network, wherein transmission times for the services are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and wherein scheduling information for different multicast and/or broadcast services provided on one channel is grouped together.

According to yet another embodiment of the present invention, there is provided a method of providing a multicast and/or broadcast service in a mobile communications network, wherein transmission times for the service are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and wherein data related to said multicast and/or broadcast service to be transmitted from a network node to a mobile terminal are grouped together before transmission.

Embodiments of the present invention will now be described, by example only, with reference to the accompanying figures, whereby:

Figs. 1 and 2 are schematic outlines of a mobile communications network, in which the present invention can be incorporated;

Figs. 3A and B are schematic diagrams illustrating a first scheduling approach for a multicast and/or broadcast service according to the prior art and a second scheduling approach according to one embodiment of the present invention;

Fig. 4 is a schematic diagram illustrating the scheduling approaches for three different multicast and/or broadcast services incorporating different embodiments of the present invention; and

Figure 5 is a schematic diagram illustrating the scheduling approaches for six different multicast services incorporating yet different embodiments of the present invention.

Figure 2 illustrates the architecture of a radio access network. The RAN comprises base stations 2, such as the so-called Node B's for the UTRAN, and radio network controllers 4 (RNC) , also referred to as base station controllers (BSC). The base stations 2 handle the actual communication across the radio interface, covering a specific geographical area also referred to as a cell. The RNCs 4 control the base stations 2 connected to it, and also include other functionality for tasks such as the allocation of radio resources, i.e. the local mobility. An RNC 4 is connected to one or more core networks 8 via the Iu interface 12, to a number of base stations 2 via the Iub interface 10 and possibly to one or more other RNCs 4 via the Iur interface 14.

In a UMTS network, the Radio Resource Control (RRC) protocol is used across the radio interface, i.e. between the UE and UTRAN. These protocol end points interact by exchanging protocol parameters, by sending messages comprising of one or more information elements.

In order to set up a MBMS session, the RNC receives a respective request from the CN. This MBMS Session Start Request contains a MBMS Service Identification, specifies the MBMS Bearer Service Type and MBMS Session Attributes such as the MBMS Service Area Information or Quality of Service parameters. After the RNC receives the MBMS Session Start Request, it notifies the UEs which are interested in and have activated the particular MBMS service.

The MBMS Session Start Request contains all information necessary to set up an MBMS Radio Access Bearer (RAB). Upon reception of the Session Start message, the RNC executes an MBMS data bearer set up over the Iu interface, and subsequently informs the sending CN of the outcome of the set up in a MBMS Session Start response message.

For a particular MBMS service, data is then transferred via an MBMS RAB between the network and the UE.

In order to set up the connections between the RNC and the UE, the existing transport channel mechanism of the Forward Access Channel (FACH) over Iub is used in case of a point-to-multipoint (ptm) MBMS

transmission. A ptm connection is established if the number of counted MBMS users in a cell exceeds a certain operator-defined threshold. Otherwise, a point-to-point (ptp) connection is established over the DTCH as defined for other dedicated services.

5   The CN sends the MBMS Session Stop command in a similar way to the RNC, and the RNC then notifies the interested and activated UEs of the end of the MBMS session. When the RNC receives an MBMS Session Stop Request, it releases the associated MBMS RAB resource.

10   **Applying a "CBS-like solution" for MBMS**

As described above a straightforward application of the CBS approach would be to signal in the scheduling message which services are going to be provided within a certain time period. This time period can for example be determined to be the next 50 System Frame numbers (SFNs).

15   A secondary Control Common Channel may carry 64kbps, may have Time Transmission Intervals (TTI) of 40ms and being adapted to carry 8 Transport Blocks (TBs) of each 320bits at every TTI. Furthermore, a maximum of 8 services could be provided per 4 SFNs, or 100 services in 50SFNs. For each service occurrence, the MAC identity needs to be identifies

20   (this may for example require 5 bits and 32 services on one sCCPCH).

The scheduling message would then have a maximum length of around 500bits per 0.5 seconds, generating overall a load of 1kbps.

The Cell Broadcast Service uses the so-called "Asynchronous Approach". This means that scheduling messages are not sent at fixed timing

25   occasions. Instead, usually in every scheduling message the optimal timing for the next scheduling message is specified, i.e. just after the time period covered by the current scheduling message.

Although this type of solution can also be considered one possible valid solution for MBMS, it can be questioned if this type of straightforward

30   application of the CBS to the MBMS case results in an optimal solution for MBMS or can be further improved.

Improvements

Starting from the above described CBS-like solution, the following issues need to be addressed:

5   1)   What is the most efficient way to signal MBMS service scheduling information ? Is signalling the contents of every TTI (which MBMS services are going to be transmitted in that TTI) an efficient approach, or are there more efficient approaches for reducing the size of the scheduling information ?

10   2)   Should scheduling information be provided at fixed positions in time (also called "synchronous"), or is it beneficial to allow an "asynchronous approach" like in CBS where the time interval between subsequent scheduling message can vary ?

3)   How do we want to group the scheduling information, e.g. one

15   message for all service on one sCCPCH, one message per service,....) ?

In the following all of these issues will be discussed.

First Embodiment

How to signal MBMS service scheduling information ?

20   A possible solution may be provided by signalling one scheduling indication per TTI, specifying which MBMS services are going to be transmitted. In this way the UTRAN scheduling typically distributes the transmission of the information belonging to a specific MBMS service at random over time. The above described solution is the straightforward

25   application of the CBS solution.

However, for MBMS the delay of the service is not very critical. Considering only the delay of the data, a delay of for example up to 0.5 seconds does not pose any problem

Referring now to Figure 3, two different scheduling approaches for one

30   MBMS service are described. In Figure 3A the scheduling approach of the

CBS-like solution is illustrated. UTRAN transmits 1 TB for the service every 40ms TTI.

In Figure 3B an alternative scheduling approach is illustrated. The information transmitted by UTRAN for this MBMS service is grouped together. UTRAN now transmits 8 TBs every 8 TTIs. Grouping together the information to be transmitted as described above results in a maximum delay of 240ms.

With the alternative approach as illustrated in Figure 3B the number of scheduling messages can be reduced. Instead of having to indicate 8 instances at which the MBMS service will be transmitted, only one instance needs to be indicated. As long as the data can be delayed up to a period of time comparable to the scheduling interval covered by the scheduling message, scheduling of "grouped information" as described above is more efficient than scheduling the information separately.

Another advantage of this approach is that scheduling information for a specific MBMS service in bursts rather than spreading it over every TTI provides the UE with more opportunity to perform neighbouring cell measurements. Note that in order to make the most time available for neighbouring cell measurements, each TTI should preferably only contain data for one MBMS service.

However, the delays introduced by grouping together information as described above should be done with care, as in case that the bursts required to transmit the information become too long, the UE might again get problems with performing measurements.

Start of MBMS Service transmission

In addition to grouping data together for each MBMS service before transmission as described above, the transmission of scheduling information may be improved by indicating for each MBMS service the next instance or the next instances in which transmission for that MBMS service will start.

The instances can for example be indicated by a list of start SFNs, which identify the starting frame, or a list of start TTIs. However, since TTIs are not numbered, for implementing the latter proposal the TTIs needs to be numbered. This can be achieved by introducing a number for the TTIs, for example at the end of the scheduling message.

Compared to a CBS-like approach, the proposed solutions result in a more efficient way of scheduling information. This may result in smaller scheduling messages. Also, the above described way of transmitting scheduling information facilitates the selection of good opportunities for performing neighbouring cell measurements for the UE.

Second Embodiment

Different time periods for different services

From a UE efficiency point of view, the period which is covered by the scheduling message should be as long as possible: it will enable the UE to plan its measurement periods well in advance and can result in large periods in which the UE can be absent without having to read an MBMS service or scheduling message.

From a UTRAN scheduling efficiency point of view, the period should be as short as possible (preferably no scheduling info) in order to maintain maximum flexibility with respect to which MBMS service to schedule when. If the period covered by the scheduling message is too long, the UTRAN may have to buffer too much data.

This will be illustrated by the following example: Assume that a scheduling message covers 60 seconds. Consider now that immediately after a scheduling message has been sent, continuous downlink data for a 256kbps service starts to arrive. In this case the UTRAN needs to buffer 1.9MB of data for this particular MBMS service.

On the other hand, for MBMS services of a lower rate longer periods of inactivity might be advantageous. These periods of inactivity may for example be 30 seconds long.

It might be thought that a potential disadvantage is that to allow scheduling periods to be of different length for different services might generate more service asynchronism between cells of different RNCs, for the following reason. In MBMS a terminal may combine the MBMS data received from different cells in order to improve the quality of reception. This requires that the transmission of the data in the two cells is, to some extent, aligned in time. However, such combining is not supported between cells of different RNCs. Hence, this asynchronism/ misalignment between cells of different RNCs is not considered to be a real drawback in practice.

Consider a second example: for a text based service and a low rate service of 1kbps, a 10 second discontinuous transmission (DTX) decreases the UE power for reading the scheduling message by a factor of 20 when compared to 0.5s scheduling message interval, and requires very little buffer capacity in the RNC. For the text based service the required buffer capacity is almost zero, and for the 1kbps service it is 1.2kB.

In the following it is discussed what the longest sensible period is for which scheduling information could be provided. Assuming a typical longest discontinuous reception (DRX) cycle of 5 seconds, and assuming that it will take about 1 longest DRX cycle to notify UEs of a service unavailability, and 2 DRX cycles for session availability, in principle an expected interruption of more than 15 seconds could already be handled by temporarily making the service unavailable. However, this will require the use of additional notification indicators (NI). Therefore, it appears that to use the service available -> service unavailable -> service available transition sequence is only advantageous if a service interruption on the order of a minute or more is expected.

Since the SFN cycle covers a 40 seconds period, a straightforward compromise is to allow service interruptions up to one SFN cycle to be signalled with the scheduling information

Above a solution has been described which allows the scheduling information to cover different periods for different services. This can for

example be achieved by specifying a smart mechanism with respect to when the UE is required to read the next scheduling message (see Third Embodiment below).

By allowing the scheduling information to cover different time periods for different services, the UE does not have to read unnecessarily additional scheduling message. In this way the power consumption can be reduced.

The advantage of providing different scheduling time periods for different services is illustrated by the following example.

It is assumed that the UTRAN can indicate ("predict") the scheduling information for a high rate service for a period of 1 second in advance, and for a low rate service for up to a minute. In this case a UE only interested in the low rate service will only need to read the scheduling message every minute.

On the other hand, if the scheduling information would only cover 1 second for both high and low rate services, even the UE which is only interested in the low rate service is required to read a scheduling message every second.

Third Embodiment
Synchronous <-> Asynchronous scheduling information

In the CBS solutions, the scheduling information is not necessarily provided at fixed points in time. Instead, a scheduling message follows the last message sent in the previous scheduling period.

This approach is referred to as "asynchronous", and provides additional flexibility to the UTRAN for the following reason. If for example the scheduling information for a certain scheduling period increases, but the UTRAN wants to keep the scheduling messages within a certain size, the UTRAN can decide to decrease the scheduling period covered by each scheduling message.

An alternative is provided by the so-called "synchronous approach": Here, the MBMS scheduling information is provided according to a pre-determined schedule. The information regarding the schedule of the

scheduling information is typically provided to the UE by a signalling means or message other than the actual scheduling message.

If a UE misses a scheduling message, for example due to an incorrect cyclic redundancy check (CRC), the UE acts in a similar way in both the asynchronous and the synchronous approach. In both cases the UE has to read the MBMS point-to-multipoint traffic channel (MTCH) on the SCCPCH continuously and handles any information it receives for the MBMS services it is interested in, until the next scheduling message is received.

However, the situation is more complicated for the asynchronous approach, i.e. in case that the scheduling information is allowed to have different periods for different services.

This will be described by means of the example below.

A scheduling message send at the time SFN=0 has the following contents:

- Service 1: SFN=10, SFN=20, SFN=30, SFN=40
- Service 2: SFN = 210

A UE which is only interested in MBMS service 2 does not read the SCCPCH until SFN210. Then the UE continues to read the SCCPCH after SFN210 until it receives the next scheduling message. The next scheduling message may for example be sent at SFN250.

Thus the approach of receiving the SCCPCH after the last know MBMS Service "start-TTI" might consume a lot of power, and might even consume more power than in the case that the UE reads the scheduling message regularly. Therefore, this asynchronous approach is disadvantageous.

On the other hand, if the scheduling messages are provided at known occasions, and scheduling messages are sent according to the general rule that any scheduling message should include all start-TTI's up to the next scheduling message after the highest indicated start-TTI, the UE only needs to read the first scheduling message after the last indicated start-TTI for the service in which the UE is interested.

Below an example is described for a synchronous scheduling approach.

A scheduling message is provided at every SFNmod64=0 and the scheduling message includes the following information:

- Service 1: SFN=10, SFN=20, SFN=30, SFN=40

- Service 2: SFN = 210

5   A UE interested in service 1 needs to read the next scheduling message at SFN=64 . Thus it listens to any transmissions between SFN=40 and SFN=64. The UE only interested in MBMS service 2 reads the next scheduling message at SFN=256.

It is noted that the UTRAN may indicate the SFN of a future scheduling

10   message in case the UTRAN knows in advance that the service is not going to be provided for quite a long period to come, but does not know at which point in time it will start to transmit the data again.

Therefore, synchronous scheduling is considered the more advantageous approach. Accordingly, scheduling information is provided in accordance

15   with a predefined schedule. Thus, the UE does not need to have received the previous scheduling message in order to know the timing of the next scheduling message.

Together with the approach described above in the second embodiment, a scheme is realised in which UEs only need to read scheduling messages

20   which are relevant for them. This will result in a reduction of the power consumption for UEs which are only interested in services for which the scheduling information can be provided well in advance.

Fourth Embodiment

25   How to transport/group the scheduling information over the SCCPCH

In a CBS-like solution, all the scheduling information to be provided in the next scheduling period is collected and transmitted in one message.

In this way reception of scheduling information is facilitated for UEs interested in multiple CBS messages, since all the relevant information is

30   provided in one message rather than in more than one message transmitted as different occasions.

An alternative approach is to provide the scheduling information for different MBMS services at different points in time instead of collecting all the information in one message.

The following approaches for providing MBMS scheduling information are considered useable:

1) a solution in which the MBMS scheduling information is provided grouped for all MBMS services provided on this SCCPCH;

2) a solution in which the MBMS scheduling information for different MBMS services might be provided at different points in time.

The first approach might be beneficial for UEs interested in multiple services and result in a lower UE power consumption for these situations.

The second approach might be beneficial for UEs interested in a limited number of MBMS services (e.g. only one), since they do not need to read a scheduling message signalled at an additional time instance.

Examples

Referring now to Figure 4, an example of providing three different MBMS services on one SCCPCH will be described. In this example different elements of how to provide scheduling information for a MBMS service as described above in the first three embodiments are combined. The approach combines the element of grouping of data and indicating the start SFNs as described in the first embodiment, the element of providing scheduling information having different periods for different MBMS services as described in the second embodiment and the element of providing a synchronous schedule as described in the third embodiment:

In this example, on a 64kbps SCCPCH, three services are provided:

1) a 32 kbps service (MBMS service 1, indicated by dark shading);

2) a variable rate service with a delay tolerance of a 640ms (MBMS service 2, indicated by light shading); and

3) a low rate service with a large delay tolerance (MBMS service 3, indicated by hatching).

The scheduling information is provided every 640ms (i.e. in SFN 256, 320,....). The table below indicates the contents of the scheduling messages transmitted at SFN256, SFN300, SFN384 and SFN448.

SFN256:	SFN320·	SFN384:	SFN448:
MBMS Service1: 256	MBMS Service1: 320	MBMS Service1: 384	MBMS Service1: 448
MBMS Service2: 296	MBMS Service2: 360	MBMS Service2: 424	MBMS Service2: 488
MBMS Service3. 508	MBMS Service3: 508	MBMS Service3: 508	MBMS Service3: 508

It can be seen from the table that the first scheduling message transmitted at SFN256 indicates the start transmitting times for Services 1,2 and 3 as SFN256, SFN296 and SFN508, respectively, The second scheduling message transmitted at SFN320 indicates the start transmitting times for Services 1,2 and 3 as SFN320, SFN360 and SFN508, respectively,

Referring now to Figure 5 another example of providing six different MBMS services on one SCCPCH is illustrated. Each of these six MBMS services is indicated by a different style of shading or hatching.

Again the scheduling information is provided every 640ms, and the two scheduling messages transmitted at SFN256 and SFN320 are illustrated. It can be seen from Figure 5 that the SCCPCH is highly loaded by providing six different MBMS services

Although the present invention has been described in the context of Multicast Broadcast services in the UMTS RAN, it is appreciated that it may also be applied to other similar systems. For UMTS, it is expected to be applicable to Release 6 and later releases.

It is to be understood that the various aspects of the different embodiments described above may be implemented individually or in any possible combination.

It is to be understood that the embodiments described above are preferred embodiments only. Various features may be omitted, modified or substituted by equivalents without departing from the scope of the present invention defined in the accompanying claims.

Claims

1.   A method of providing a multicast and/or broadcast services in a mobile telecommunications network,

wherein transmission times for the services are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and

wherein the scheduling information is provided according to a predefined schedule.

2.   A method according to claim 1, wherein the scheduling information is provided periodically at predefined times.

3.   A method according to claim 1 or 2, wherein the scheduling information is provided for a plurality of services.

4.   A method according to claim 1, 2 or 3, wherein the scheduling information includes the start time of the data transmission for one or more services.

5.   A method according to any of claims 1 to 4, wherein the scheduling information includes the duration of the data transmission for one or more services.

6.   A method according to any of claims 1 to 4, wherein the scheduling information includes the end of the data transmission for one or more services.

7.   A method according to any of claims 1 to 6, wherein one scheduling message includes the scheduling information for a predetermined period of providing services.

5   8.   A method according to any of claims 1 to 7, wherein one scheduling message includes the scheduling information for a plurality of services.

9.   A method according to any of claims 1 to 8, wherein the
10   transmission periods covered by the scheduling information are specific to a particular service.

10.   A method according to any of claims 1 to 9, wherein the transmission of at least some data related to one of said services are delayed
15   such that data related to said one service are grouped together

11.   A method of providing a multicast and/or broadcast services in a mobile telecommunications network,

wherein transmission times for the services are scheduled and
20   scheduling information is transmitted from a network node to a mobile terminal, and

wherein one scheduling message includes the scheduling information for a predetermined period of providing services.

25   12.   A method of providing a multicast and/or broadcast service in a mobile communications network, including transmitting data for a multicast and/or broadcast service from a network node to a mobile terminal,

wherein transmission times for transmitting data relating to the service are scheduled and wherein scheduling information is transmitted from a network node to a mobile terminal, and

wherein transmission of at least some of said data is delayed so that data relating to said service are grouped together before transmission.

13.   A method according to claim 12, wherein the maximal delay for a particular multicast and/or broadcast service is predetermined.

14.   A method of providing multicast and/or broadcast services in a mobile communications network, wherein transmission times for the service are scheduled and scheduling information including the start times of the transmission related to a particular multicast and/or broadcast service is transmitted from a network node to a mobile terminal.

15.   A method according to claim 14, wherein said scheduling information is specific to a particular service.

16.   A method according to claim 14 or 15, wherein one or more system frame numbers are specified at which data transmission is to be started.

17.   A method according to claim 14 or 15, wherein one or more time transmission intervals are specified at which data transmission is to be started.

18.   A method of providing multicast and/or broadcast services in a mobile communications network,

wherein transmission times for the services are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and

wherein the transmission periods covered by the scheduling information are specific to a particular multicast and/or broadcast service.

19.   A method according to claim 18, wherein the transmission periods covered by the scheduling information for different multicast and/or broadcast services have different lengths.

20.   A method of providing multicast and/or broadcast services in a mobile communications network,

wherein transmission times for the services are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and

wherein scheduling information for different multicast and/or broadcast services provided on one channel is grouped together.

21.   A method according to claim 20, wherein the scheduling information for different multicast and/or broadcast services on a particular secondary common control physical channel is grouped together.

22.   A method according to claim 20 or 21, wherein the scheduling information for all multicast and/or broadcast services provided on said channel is grouped together.

23.   A method of providing a multicast and/or broadcast service in a mobile communications network,

wherein transmission times for the service are scheduled and scheduling information is transmitted from a network node to a mobile terminal, and

wherein data related to said multicast and/or broadcast service to be transmitted from a network node to a mobile terminal are grouped together before transmission.

24. A method according to claim 23, wherein transmission of at least some of said data is delayed.

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25. A method according to any of claims 1 to 24, wherein the mobile communications network includes an UMTS network.

26. A method according to any of claims 1 to 24, wherein the

10 multicast and/or broadcast service includes the Multimedia Multicast Broadcast Service MBMS in an UMTS network.

27. A mobile communications network adapted to implement the method of any of claims 1 to 26.

Application No:	GB0506995.0	Examiner:	Anita Keogh
Claims searched:	1-10, 25-27	Date of search:	19 September 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-7, 9, 25-27	WO 2004/017540 A1 (LG ELECTRONICS) see abstract and whole document
X,E	1, 2, 4, 5, 6 at least	WO 2005/078962 A1 (LG ELEECTRONICS) see abstract and whole document, especially paragraphs 21-40
X,E	1, 2, 4, 6 at least	WO 2005/048621 A1 (NEC) see patent abstract, WPI online database abstract and especially figures 3-5
X	1, 2, 4, 7 at least	US 2002/0072378 A1 (GAAL) see abstract and e.g. especially paragraphs 12-13, 42-47 & 55-57
X	1, 2, 4, 5, 6, 25-27	WO 2004/017541 A1 (LG ELECTRONICS) see claims 29-35
A,P	All	GB 2398971 A (NEC) see abstract
A,P	All	GB 2405557 A (NOKIA) see abstract and whole document
A,E	All	GB 2406997 A (NEC) see abstract and whole document

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H04B; H04L; H04Q

The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC, JAPIO